FORM PTO-1390 (REV. 11-2000) U S DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY 'S DOCKET NUMBER

U S APPLICATION NO (If known, see 37 CFR 1.5): 09/743925

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/RU99/00254	14 July 1999	17 July 1998

TITLE OF INVENTION: Method of applying metal coatings on particles and substrates.

APPLICANT(S) FOR DO/EO/US: Elena L. FOKINA, Nadezhda I. BUDIM, Galina G. CHERNIK

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [+] This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. [ ] This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. [+] This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. [+] The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. [+] A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. [+] is attached hereto (required only if not communicated by the International Bureau).
   b. [ ] has been communicated by the International Bureau.
   c. [ ] is not required, as the application was filed in the United States Receiving Office (RO/US).
6. [+] An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. [+] is attached hereto.
   b. [ ] has been previously submitted under 35 U.S.C. 154(d)(4).
7. [ ] Amendments to the claims of the International Aplication under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. [ ] are attached hereto (required only if not communicated by the International Bureau).
   b. [ ] have been communicated by the International Bureau.
   c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [ ] have not been made and will not be made.
8. [ ] An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).
9. [+] An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. [+] An English lanugage translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 20 below concern document(s) or information included:

11. [ ] An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. [ ] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. [ ] A FIRST preliminary amendment.
14. [ ] A SECOND or SUBSEQUENT preliminary amendment.
15. [ ] A substitute specification.
16. [ ] A change of power of attorney and/or address letter.
17. [ ] A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
18. [ ] A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. [ ] A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. [+] Other items or information:
    Statement claiming small entity status

U.S. APPLICATION NO (if known, see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO	ATTORNEY'S DOCKET NUMBER
09/743925	PCT/RU99/00254	

21. ☐ The following fees are submitted:	CALCULATIONS PTO USE ONLY	
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):		
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO **$1000.00**		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO **$860.00**		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO **$710.00**		
International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) **$690.00**		
International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) **$100.00**		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 1000	
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	$	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	- 20 =		x **$18.00**	$	
Independent claims	- 3 =		x **$80.00**	$	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ **$270.00**	$	
TOTAL OF ABOVE CALCULATIONS =				$ 1000	
☐ Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2. +				$ 500	
SUBTOTAL =				$ 500	
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				$	
TOTAL NATIONAL FEE =				$ 500	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +				$	
TOTAL FEES ENCLOSED =				$ 500	
				Amount to be refunded:	$
				charged:	$

a. ☐ A check in the amount of $ 500 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. _____ in the amount of $ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☐ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. _____ . A duplicate copy of this sheet is enclosed.

d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO.

Signature (G.G. Chernik)
SIGNATURE

Galina G. CHERNIK
NAME

REGISTRATION NUMBER

PTO/SB/09 (12-97)
Approved for use through 9/30/00. OMB 0651-0031
Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

STATEMENT CLAIMING SMALL ENTITY STATUS (37 CFR 1.9(f) & 1.27(b))–INDEPENDENT INVENTOR	Docket Number (Optional)

Applicant, Patentee, or Identifier: Elena Leonidovna FOKINA

Application or Patent No.: PCT/RU99/00254

Filed or Issued: 14 July 1999

Title: Method of applying metal coatings on particles and substrates.

As a below named inventor, I hereby state that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees to the Patent and Trademark Office described in:

☐ the specification filed herewith with title as listed above.

☒ the application identified above.

☐ the patent identified above.

I have not assigned, granted, conveyed, or licensed, and am under no obligation under contract or law to assign, grant, convey, or license, any rights in the invention to any person who would not qualify as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern, or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

☐ No such person, concern, or organization exists.

☒ Each such person, concern, or organization is listed below.

Nadezhda Ivanovna Budim
Galina Georgievna Chernik

Separate statements are required from each named person, concern, or organization having rights to the invention stating their status as small entities. (37 CFR 1.27)

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

Elena L. FOKINA	Nadezhda I. BUDIM	Galina G. CHERNIK
NAME OF INVENTOR	NAME OF INVENTOR	NAME OF INVENTOR
Signature of inventor	Signature of inventor	Signature of inventor
January 3, 2001	January 3, 2001	January 3, 2001
Date	Date	Date

PTO/SB/09 (12-97)
Approved for use through 9/30/00 OMB 0651-0031
Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE

STATEMENT CLAIMING SMALL ENTITY STATUS (37 CFR 1.9(f) & 1.27(b))–INDEPENDENT INVENTOR	Docket Number (Optional)

Applicant, Patentee, or Identifier: Galina Georgievna CHERNIK

Application or Patent No.: PCT/RU99/00254

Filed or Issued: 14 July 1999

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- ☒ the application identified above.
- ☐ the patent identified above.

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- ☒ Each such person, concern, or organization is listed below.

Elena Leonidovna Fokina

Nadezhda Ivanovna Budim

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NAME OF INVENTOR	NAME OF INVENTOR	NAME OF INVENTOR
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Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

STATEMENT CLAIMING SMALL ENTITY STATUS (37 CFR 1.9(f) & 1.27(b))–INDEPENDENT INVENTOR	Docket Number (Optional)

Applicant, Patentee, or Identifier: Nadezhda Ivanovna BUDIM

Application or Patent No.: PCT/RU99/00254

Filed or Issued: 14 July 1999

Title: Method of applying metal coatings on particles and substrates.

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Galina Georgievna Chernik

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Elena L. FOKINA	Nadezhda I. BUDIM	Galina G. CHERNIK
NAME OF INVENTOR	NAME OF INVENTOR	NAME OF INVENTOR
Signature of inventor	Signature of inventor	Signature of inventor (G.G. Chernik)
January 3, 2001	January 3, 2001	January 3, 2001
Date	Date	Date

METHOD OF APPLYING METAL COATINGS ON PARTICLES AND SUBSTRATES..

Technical Field

The present invention relates to the technology of applying metal coatings on the surfaces of various materials (particles and substrates) including dielectrics, semiconductors and metals. The invention can be used, for example, for the metallization of abrasive particles, in applying metal coating to ceramic materials and in electronics.

Background Art

The techniques conventionally used for applying metal coatings on the surfaces of materials include chemical vapor-phase deposition, plasma assisted deposition, metal bath deposition, electroless deposition, electrolytic deposition and solid-phase reaction techniques.

The technique of vapor-phase deposition (patents US 5 250 086, US 5 232 469, US 5 224 969, US 5 126 207, US 5 024 680, US 4 399 167, US 3 924 031, US 3 871 840, US 3 650 714) uses gaseous mixtures at low pressures and high substrate temperatures for the deposition of carbide-forming metals, such as chromium, titanium and zirconium. For example, patent US 5 224 969 describes a process in which a layer of fine chromium powder is mixed with the diamond and heated to elevated temperatures (600-700 °C) under 10^{-6} torr vacuum (or in the atmosphere of argon or hydrogen). During the process agitation is applied in order to prevent the particles from adhering to one another. The treatment causes the metal powder to vaporize and redeposit on the surfaces of the diamond powder forming metal carbide. The drawbacks of this technique include the use of elevated temperatures (600-700 °C) which causes diamond degradation, the use of expensive carbide-forming metals, the necessity to apply a second layer of metals which are more oxidation resistant and the necessity to apply agitation in order to prevent the particles from adhering to one another.

Plasma assisted deposition technique (US 5 489 449) allows one to obtain an adherent

metal coating on a flat dielectric substrate. In the case of coating a powder it is necessary to create fluidized bed conditions in order to prevent particles from adhering to one another. This causes high expenditure of purified gases, especially if the particles are relatively large (more than 40 μm). Other disadvantages of the technique include the use of elevated temperatures, expensive reactors, high expenditure of oxygen-free gas and short lifetime of the electrodes.

In the technique of packed salt bath deposition (US 5 250 086, US 5 224 969, US 5 306 318, US 5 090 969) abrasive particles are immersed within a molten bath of one or more alkali or alkaline earth halides with a carbide-forming metal, such as chromium, titanium, tungsten, zirconium, vanadium, niobium, tantalum, molybdenum, the process operating at 600 - 100 °C, for chromium, preferrably, between 800-950 °C (US 5 250 086). Patent US 5 306 318 describes the process of coating particles of cubic boron nitride with titanium; patent US 5 090 969 describes the use of molten alkali metal ftoride for the metallization of diamond and cubic boron nitride. The disadvantages of the technique include the use of elevated temperatures (600-700 °C), which causes diamond degradation, the use of expensive carbide-forming metals, the necessity to apply a second layer of metals which are more oxidation resistant and the necessity to apply agitation in order to prevent the particles from adhering to one another. The melts containing titanium (US 3 929 432) and titanium hydrides (US 4 591 363) have been described. Mechanical crushing of sintered particles aggregates is needed in this case, which leads to appearance of uncoated areas, cracks and other defects.

In the electrolytic method (US 5 421 989) dielectric materials first must be coated with a layer of metal by means of other techniques. The technique does not have the drawbacks of the described above methods and is characterized by high productivity; however, in case of powders containing up to 50 w. % of metal the quality of the metal coating obtained is low.

Electroless technique (US 4 435 189, US 5 188 643, US 5 648 125. US 5 221 328, US 4 997 686, US 4 520 052) comprises degreasing, cleaning, activation and sensibilization of the surface of a dielectric material with a subsequent reducing of a metal on the surface from the metal salt solution. The process is slow; increasing metal content in the solution

leads to segregation of coarse metal particles and the coated material; the degree of coverage is low (coverage coefficient 50-70 %) which can be explained by the low density of metal crystallization centers on the surface of the dielectric material. In this technique it is difficult to control the thickness of the metal layer.

Solid-phase reactions are utilized in the process of coating in a number of patents (US 4 063 907, US 5 256 443, EP 0 513 821, EP 0 508 399). Patent US 4 063 907 describes a process in which mechanical treatment of abrasive particles and metal compounds is used, with a metal compound being able to be decomposed or reduced at atmospheric pressure and temperatures 800-1400 °C, e.g. molibdenium, tungsten, titanium, niobium, tantalum, chromium and zirconium sulfides. The use of high temperatures and low degree of coverage of the material are disadvantages of the technique. Patent EP 0 513 821 describes a process in which a thin film of solution containing a noble metal alkoxide is deposited on the surface of a substrate, dried and heated in a reducing atmosphere in order to obtain a thin film of noble metals and/or in oxidizing atmosphere in order to obtain a thin film of noble metal oxides. Patent 5 256 443 describes a process in which a sol containing noble metal alkoxides is prepared, and a thin film is dried until a gel is formed. The technique does not permit to obtain a thick adherent coating; the reagents (metal alkoxides and palladium salts) are expensive.

Patent EP 0 508 399, which is the closest analog of the present invention (prototype), describes a process in which a substrate and an organic salt of a metal are heated to temperatures not higher than 400 °C at low pressure in the presence of palladium salts. Pyrolysis of the organic salt of metal takes place, and the products of the pyrolysis form the necessary coating on the substrate.

Disadvantages of the prototype process (EP 0 508 399) are following:

1. It is impossible to obtain a coating which would be dense, adherent and thick, because a substantial amount of gaseous products is formed during decomposition of the organic salts of metals, which leads to porosity and low adherence of the coating.
2. If this method is applied to powder dielectric materials, it is laborious and expensive, as in this case it is necessary to agitate the powder during the process of pyrolysis of the organic salt of metal by means of creation of the fluidized bed conditions or by

means of pulverization and drying. If this process is not performed, mechanical crushing of sintered particles aggregates is needed in this case, which leads to appearance of uncoated areas, cracks and other defects. This is a common drawback of all methods comprising mechanical crushing of sintered aggregates (patents US 3 929 432, US 4 591 363).

3. The reagents (organic salts of metals and palladium salts) are expensive.

Disclosure of Invention

The goal of the present invention is to obtain a dense adherent coating with a controlled thickness on the surface of various materials which are able to withstand heating to 200-500 °C (diamond, abrasives, ceramics, glass, dielectrics, semiconductors, metals), the coating having high degree of coverage and the process being highly productive and inexpensive.

The goal is achieved in the following way: after degreasing and cleaning of the surface of materials, the particles of a compound chosen from the group of metals, alloys, metal oxides, metal hydroxides, metal sulfides (metals are copper, nickel, aluminum, zinc, titanium, tungsten, germanium, gold, cobalt, molybdenum, tin, palladium, platinum) are mechanically smeared on the surface of the material with a subsequent reducing of the compound in non-oxidizing atmosphere on heating to 200-500 °C.

In contrast to the process described in the prototype patent EP 0 508 399, said inorganic compounds release small amounts of gaseous products of decomposition, which allows one to obtain a dense adherent coating with a high degree of coverage. The thickness and degree of coverage were estimated by the technique of X-ray diffraction (see Mode 1). Adherence of the obtained coating was estimated by means of comparison of the X-ray diffraction patterns of the metallized powder before and after treatment in an ultrasonic bath (see Mode 3). The described technique is less laborious and less expensive than the prototype as its application to the coating of powders does not require neither fluidized bed conditions nor pulverization and drying; expensive reagents such as palladium salts and organic salts of metals are not needed.

Degreasing of the surface is usually performed in an alkaline solution. Cleaning of the surface can be performed by etching in dilute acid or by other methods, for example, by laser treatment of the surface of the substrate (S.M. Pimenov, G.A. Shafeev, V.A. Laptev, E.N. Loubnin, Appl. Phys. Lett., 64 (15) 1994, p. 1935-1937). The materials which can be coated by means of the described process are: synthetic and natural diamond, cubic boron nitride, corundum, ruby, sapphire, silicon carbide, fianite, ceramics, glass, semiconductors and other materials that are able to withstand heating to said temperatures.

Coating may contain copper, nickel, aluminum, zinc, titanium, tungsten, germanium, gold, cobalt, molybdenum, tin, palladium, platinum and their alloys. Mechanical smearing of the particles, which would form coating, is achieved by mixing in various mills and mixers. If the surface to be coated is flat, one has to spread the particles on the surface by rolling or by pouring a suspension with a high content of the solid phase with a subsequent drying and rolling. A substrate having a complex shape can be treated with the help of pulverization of a suspension or of a powder.

The compounds that serve to form a coating are monoxide and dioxide of copper, monoxide of nickel, oxides, hydroxides and sulfides of said metals. One can also use metal powder. Reduction can be performed in the atmosphere of argon, purified nitrogen or hydrogen or at low pressure (10^{-3} torr). The value of the maximum temperature of heating depends upon the nature and degree of purification of the gas used, upon the pressure maintained and upon the compound used for coating. When hydrogen or other oxygen-free dry gas or vacuum (10^{-3} torr) are applied, it is necessary to heat to 200-500 °C. One or several layers of the metal coating can be deposited by means of the described technique or by other methods on the metal coating obtained. The metal coating obtained can be protected from oxidation by treatment in organic solvents (CF_2Cl_2, $CHClF_2$ or CF_4). Sometimes it is necessary to obtain a layer of metal oxide on a substrate or on a powder. In this case the metal layer obtained is heated in oxidizing atmosphere till the required degree of oxidation is attained.

The metal coating produced by the described method is characterized by high density and high value of adhesion to the surface of the coated material; one can obtain a coating of

desired thickness and degree of coverage; 100 % degree of coverage can be achieved. The method is also advantageous in that the process is performed at relatively low temperatures and does not require neither equipment of complicated design nor expensive reagents, the process has high productivity and it can be organized in such a way that it has no waste products. The metal coating obtained has a rough surface, which provides good retention of metallized abrasive grains both in metal and organic matrixes of abrasive instruments.

The present invention is explained below in more detail by reference to the following Modes, but the invention is not construed as being limited thereto.

Modes for Carrying Out the Invention.

Mode 1. (Best mode)

After degreasing, cleaning and drying, synthetic diamond powder (particle size 50 μm) was mixed with copper dioxide (diamond/copper weight ratio 1:1). Mixing balls (diameter 5 mm), which had been previously treated (fettled) by copper dioxide, were put in the mixer; the ratio of the masses of mixture and mixing balls was 2:1. The process of mixing took 20 min. The mixture was heated to 450 °C in the atmosphere of oxygen-free dry argon. The end of the gas release indicated the end of the process. After cooling the powder was treated by CF_2Cl_2 and dried. Productivity in this case was 3 kg/hr for the reactor of 6 liters.

The degree of coverage and the thickness were estimated with the help of X-ray diffraction technique. The depth of penetration of CuKα radiation in a copper sample is more than 3 μm. The diffraction maximums corresponding to the structure of diamond were not observed in the X-ray diffraction pattern of the dimond powder coated with copper. Thus, a conclusion can be made that the thickness of the coating is more than 3 μm and the degree of coverage is 100 % (the accuracy of the measurements is 0.5 %).

Mode 2.

After degreasing, cleaning and drying, powder of cubic boron nitride (particles of 50-60 μm) was immersed in an aluminum suspension. The suspension had been obtained by means of mixing aluminum powder in a solvent containing water and ethanol for 15-30 min. The solvent was then evaporated at 100 °C and the mixture was heated in a closed reactor at temperatures 250-300 °C. After cooling the powder was treated by $CHClF_2$ and dried. The degree of coverage was estimated by the technique of X-ray diffraction and was found to be 90-95 % (the accuracy of determination was 0.5 %).

Mode 3.

After degreasing, cleaning and drying, corundum powder (Al_2O_3, particles size 60-80 μm) was immersed in a titanium suspension. The suspension had been obtained by mixing of titanium powder in a solution containing water and ethanol for 15-30 min. The solvent was then evaporated at 100 °C and the mixture was heated in a closed reactor at temperatures 250-300 °C. After cooling the powder was treated by CF_4 and dried.

Adherence of the coating was estimated by comparison of the X-ray diffraction data obtained before and after treatment of the metallized powder in an ultrasonic bath at frequency 20 kHz for 3 min. No difference between the X-ray diffraction spectra of the metallized powder before and after ultrasonic treatment was found, which is an evidence of a high value of adhesion at the metal/dielectric boundary.

Mode 4.

A ceramic plate containing zirconium dioxide was degreased, cleaned and dried. A suspension of high solid phase content was poured on the surface of the plate to form a film of 10 μm. The suspension had been prepared by mixing nickel monoxide (90 %), polyvinilbutiral, plastifier and stabilizer in a mill containing milling balls. After drying the plate was heated in the atmosphere of dry hydrogen at 390 °C Release of the calculated amount of water indicated the end of the process. After cooling the plate was treated in CF_2Cl_2 and dried.

Industrial application.

The invention can be used in industry in applying metal coatings on the surfaces of various materials (particles and substrates) including dielectrics, semiconductors and metals. It can be used, for example, in manufacturing of abrasive tools for the metallization of abrasive particles, in automotive industry for producing metal-matrix composites, in applying metal coating to ceramic materials and in electronics in manufacturing of such devices as heat sinks, circuit boards, resistors, electrodes, sensors and magnetic media.

Claims.

1. A method of applying a metal coating on the surface of materials (powders and substrates) which comprises degreasing, cleaning and drying of the surface and mechanical smearing of the particles of a compound chosen from the group of metals, alloys, metal oxides, metal hydroxides, metal sulfides (metals are copper, nickel, aluminum, zinc, titanium, tungsten, germanium, gold, cobalt, molybdenum, tin, palladium, platinum) on the surface of the material with a subsequent reducing of the compound on heating in non-oxidizing atmosphere.
2. A method as claimed in claim 1, wherein said mechanical smearing of said particles on powders is carried out with the help of mixing in mills and mixers.
3. A method as claimed in claim 1, wherein said mechanical smearing of said particles on flat surfaces is carried out by rolling or by pouring a high solid phase content suspension with a subsequent drying and rolling.
4. A method as claimed in claim 1, wherein said mechanical smearing of said particles on the surface of a substrate having a complex shape is carried out with the help of pulverization of a suspension or of a powder.
5. A method as claimed in claim 1, wherein copper monoxide and dioxide and nickel monoxide are used as said compounds which form the metal coating, and heating is performed in non-oxidizing atmosphere to temperatures 200-500 °C.
6. A method as claimed in claim 1, wherein said mechanical smearing of said metals and alloys is performed in non-oxidizing atmosphere to temperatures 200-300 °C.
7. A method as claimed in claim 1, wherein one or several secondary layers of metal are applied to the surface of the primary metal layer and/or metal layer is protected from oxidation by treatment in organic solvents (CF_2Cl_2, $CHClF_2$ or CF_4).
8. A method as claimed in claim 1, wherein metal layer obtained is heated in an oxidizing atmosphere until the required degree of oxidation is obtained.
9. A method as claimed in claim 1, wherein the material to be coated is an abrasive powder (synthetic or natural diamond, cubic boron nitride, corundum, ruby, sapphire, silicon carbide).
10. A method as claimed in claim 1, wherein metallized abrasive particles are sintered with metal by the technique of hot pressing in an inert atmosphere in order to obtain a compact for manufacturing of an abrasive instrument.

11. A method as claimed in claim 1, wherein said material with a metal coating is an element of an electronic device.

Please type a plus sign (+) inside this box → ☒

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DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63)

☒ Declaration Submitted with Initial Filing **OR** ☐ Declaration Submitted after Initial Filing (surcharge (37 CFR 1.16 (e)) required)

Attorney Docket Number	
First Named Inventor	Fokina
COMPLETE IF KNOWN	
Application Number	/
Filing Date	
Group Art Unit	
Examiner Name	

As a below named inventor, I hereby declare that:

My residence, mailing address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Method of applying metal coatings on particles and substrates.

(Title of the Invention)

the specification of which

☐ is attached hereto

OR

☒ was filed on (MM/DD/YYYY) 07/14/1999 as United States Application Number or PCT International Application Number PCT/RU99/00254 (if applicable).

and was amended on (MM/DD/YYYY) _____

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached? YES	NO
RU 2149217	Russia	07/17/1998	☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐

☐ Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto:

I hereby claim the benefit under 35 U.S.C. 119(e) of any United States provisional application(s) listed below.

Application Number(s)	Filing Date (MM/DD/YYYY)

☐ Additional provisional application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

Please type a plus sign (+) inside this box → [+]

PTO/SB/01 (10-00)
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DECLARATION — Utility or Design Patent Application

Direct all correspondence to: ☐ Customer Number or Bar Code Label [ ] OR [+] Correspondence address below

Name Galina G. Chernik

Address pr. Veteranov 31-8

Address

City	State	ZIP
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Country	Telephone	Fax
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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

NAME OF SOLE OR FIRST INVENTOR : ☐ A petition has been filed for this unsigned inventor

Given Name (first and middle [if any]) Elena Leonidovna **Family Name or Surname** FOKINA

Inventor's Signature [signature] **Date** January 3,2001

Residence: City	State	Country	Citizenship
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Mailing Address ul. Dem'yana Bednogo 2-1-128

Mailing Address

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NAME OF SECOND INVENTOR: ☐ A petition has been filed for this unsigned inventor

Given Name (first and middle [if any]) Nadezhda Ivanovna **Family Name or Surname** RUDIM

Inventor's Signature [signature] **Date** January 3, 2001

Residence: City	State	Country	Citizenship
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Mailing Address Tikhoretsky pr., 25-5-100

Mailing Address

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St. Petersburg		195427	Russia

[+] Additional inventors are being named on the 1 supplemental Additional Inventor(s) sheet(s) PTO/SB/02A attached hereto.

Please type a plus sign (+) inside this box → [+]

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DECLARATION

ADDITIONAL INVENTOR(S)
Supplemental Sheet
Page 1 of 1

Name of Additional Joint Inventor, if any:	☐ A petition has been filed for this unsigned inventor
Given Name (first and middle [if any])	Family Name or Surname
Galina Georgievna	CHERNIK
Inventor's Signature Чеин (G.G. Chernik)	**Date** January 3, 2001
Residence: City St. Petersburg **State** RUX	**Country** Russia **Citizenship** Russia
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Name of Additional Joint Inventor, if any:	☐ A petition has been filed for this unsigned inventor
Given Name (first and middle [if any])	Family Name or Surname
Inventor's Signature	**Date**
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Name of Additional Joint Inventor, if any:	☐ A petition has been filed for this unsigned inventor
Given Name (first and middle [if any])	Family Name or Surname
Inventor's Signature	**Date**
Residence: City **State**	**Country** **Citizenship**
Mailing Address	
Mailing Address	
City **State**	**ZIP** **Country**